DOCUMENT RESUME

ED 312 841 EC 221 299

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TITLE An Additional Handicap: Visual Perceptual Learning Disabilities of Deaf Children.
PUB DATE Jun 88
NOTE 12p.; In: Kemp, Faye, Ed.; And Others. New Directions in Resources for Special Needs Hearing Impaired Students: Outreach '88. Proceedings of the Annual Southeast Regional Summer Conference (8th, Cave Spring, Georgia, June 14-17, 1988); see EC 221 298.
PUB TYPE Speeches/Conference Papers (150) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Deafness; Etiology; *Handicap Identification; *Learning Disabilities; Mathematics Achievement; *Multiple Disabilities; *Perceptual Handicaps; Sign Language; *Visual Perception

ABSTRACT

The paper examines issues concerned with the incidence of visual perceptual learning disabilities among deaf and partially hearing children. Evidence indicating a high incidence (15.5 percent of 682 deaf students) of visual perceptual deficits is offered, as is a definition of visual perception. The impact of visual perceptual deficits on educational performance is discussed especially in the areas of writing and mathematics. The most devastating effect of the disorder is seen to lie in decreased ability to comprehend sign language. Causes of learning disabilities in deaf children are suggested. Characteristics of this population are discussed along with the effects of inappropriate tests which may fail to identify these students. (DB)

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AN ADDITIONAL HANDICAP: VISUAL PERCEPTUAL LEARNING DISABILITIES OF DEAF CHILDREN

Vivienne Ratner, Ph.D.

There has been increasing concern about appropriate servicing of hearing impaired children with specific learning disabilities. The Annual Survey of Hearing-Impaired Children and Youth, 1981-82, by Gallaudet University Center for Assessment and Demographic Studies, revealed that 7.5 percent of the 51,962 hearing impaired children included in the Survey had specific learning disabilities in addition to their hearing impairment (Karchmer, 1985).

I propose that the incidence of learning disabilities among hearing impaired children is considerably higher than 7.5 percent, but we do not have appropriate tests that are standardized on a hearing impaired population to diagnose specific deficits.

A particularly high incidence of visual perceptual learning disabilities has been identified among 682 deaf children by this author. Research has just been completed using two new tests designed specifically for hearing impaired students, the Test of Visual Perceptual Abilities (TVPA) and the Test of Spatial Perception in Sign Language (TSPSL). The tests identified a primary handicapping condition entirely distinct from deafness that has devastating effects upon the deaf child ... visual perceptual learning disabilities.

The objective of this article and of the presentation by the author at the 8th Annual Southeast Regional Conference

EC 221799

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is to describe the educational impact of this "Handicapping Condition", as defined in Public Law 94-142.

Definition of Visual Perception

Visual perception has to do with the "understanding" of the visual stimulus. It is the process of organizing and interpreting all the minute details of the visual scene obtained through the retinas of the eyes. A person can have 20/20 visual acuity and still not be able to interpret all the details of the visual scene without distortion. In addition, a visual perceptual deficit cannot be corrected by prescription glasses.

Review of Relevant Research

Current research has revealed several important findings related to the organization of the human brain and the cortical areas involved with visual perception and with the processing of spatial information.

While the left hemisphere of most persons controls activities subsuming language, it is becoming increasingly apparent that the right hemisphere is specialized for the skills that enable us to process spatial information and discriminate a variety of shapes, forms, textures, patterns, and movements.

In deaf signers the left hemisphere is dominant for sign language just as it is for spoken language, even

though sign language is conveyed by moving hands in space. The right hemisphere, however, controls gross spatial organization in signing (Poizner & Bellugi, 1984,1985). The right hemisphere also has been found to be more efficient than the left in providing awareness of the existence and position of different body parts, and the ability to identify similar body parts in others (Rapin, 1982; Kolb & Whishaw, 1985; Gaddes, 1985; Benton et al, 1983).

Using complex sophisticated technological devices, individual pathways, and even specific neurons within the visual cortex, have been isolated. Each of these independently process static, 3-dimensional drawings and also simple line drawings, form and shape information, orientation of lines, edges, corners and angles, location of objects in space, spatial organization, direction of movement, pattern of movement and depth in space. (Livingston & Hubel, 1983; Treisman, 1986; Regan, Beverly, and Cynader, 1979; Hubel, Wiesel & Strykes, 1978; Hubel & Wiesel, 1962).

Incidence of Visual Perceptual Deficits in Deaf Children

The Test of Visual Perceptual Abilities (TVPA) has been designed by the author to detect visual perceptual learning disabilities. It differs from existing tests of visual perception in that it uses moving stimuli.

With brain organization in mind, the complex umbrella term, "Visual Perception" was broken down into specific subskills:

Static Stimuli

Discrimination of Static Shape
Discrimination of Static Size
Spatial Relationships Between Static Objects
Visual Closure Perception
Visual Figure-Ground Perception
Perception of Space Between Objects

Dynamic Stimuli

Size Constancy (Perception of Size of Moving Objects)
Perception of Changing Spatial Locations of Objects
Perception of Spatial Relationships of Moving Objects
Visual Memory (Temporal-Spatial Integration)
Perception of Body Boundaries
Shape Constancy (Perception of Changing Dynamic Objects)

The Test of Spatial Perception in Sign Language (TSPSL) is not a test of sign vocabulary; the items were designed as examples of spatial components in sign language. Together, the TVPA and TSPSL can detect the inability of the youngster to perceive changing, moving handshapes used by a signing speaker, the assigned location of people and objects, and the direction they are moving in the signed communication.

The TVPA and the TSPSL were administered to 682 deaf students. The objective of the research was to identify those students who have visual perceptual deficits and determine how these deficits impact on classroom performance and upon the student's ability to comprehend sign language. The results revealed that 1) 15.5 percent of the 682 students, ages 8 - 18 years, had deficits in 2 or more subskills of visual perception, 2) 45 percent of the deficits in comprehending spatial components of sign language were directly related to the deficits in subskills of visual perception (Ratner, 1988).

Impact on Educational Performance

Educationally, there is a complex picture of peaks and valleys. This particular aspect cannot be over-emphasized. These visual perceptual deficits are specific and affect specific academic areas. In other academic areas the child will excel. The concept that different perceptual skills are processed in different areas of the cortex could explain why children with the disorder often excel in one academic area and fall apart in another. These areas of competence and deficiency differ with each child and with each visual perceptual deficit. This is a major difference between the learning disabled deaf child and the mentally retarded deaf child. The MR child will reveal depressed performance across all academic areas.

In some cases, the problems are observed when writing. The child writes on a slant down the paper and not on the horizontal line. Written letters and numbers are bunched together. The child cannot discriminate the space between letters within a word and the space between words in a sentence. The sentence, therefore, becomes one long word.

In other cases, the problem is more obvious in mathematics. The children reveal serious deficits in mathematical concepts (described in detail, Ratner, 1985). They cannot differentiate similar geometric shapes, e.g. rectangle, parallogram, square. They do not understand concepts involved in geometry. They cannot align numbers. They switch back and forth when adding

two columns of numbers. They have difficulty aligning the numbers in multiplication and long division problems. They cannot accurately perceive the position of a decimal. Youngsters who have difficulty estimating space cannot understand volume, perimeter or area. Fractions cause a great deal of frustration because the children cannot differentiate equal-sized parts from unequal-sized parts. They may have additional problems because they cannot separate and discriminate the lines on a ruler or a graph. Closure deficits also cause difficulty. Students who have closure deficits will not be able to identify an object when the configuration is outlined by a broken line. They will not be able to differentiate bars in a graph or chart consisting of dotted lines, x marks or slashes. To compound the problem, these students are often assigned to remediation on the computer that has a dot matrix. No one seems to consider whether the student can 1) read accurately on a vertical screen, 2) read the numerals or the written sentences presented in a glaring green or orange dot matrix, 3) align numerals or keep track of the printed matter that is presented horizontally on a vertical screen with just space to separate them, not lines.

Sign Language Comprehension

Perhaps the most devastating effect of the disorder is on the ability to comprehend sign language. Frequently, this child has difficulty differentiating body parts on himself and on the

signing speaker who is rotated 180 degrees. Confusion is also caused by the following problems directly due to visual perceptual deficits: He cannot perceive the exact position and level of the speaker's hands on or near the body. He cannot perceive depth in space. He becomes confused about direction and orientation of the speaker's hand movements. He cannot accurately perceive the location of objects as they are placed in the signing space in the course of the signed communication.

A deaf child's language and concept development are seriously impaired when visual perceptual deficits interfere with any of the above skills essential to sign language comprehension. They interfere with the comprehension of the directions and instructions of the classroom teacher and impair educational advancement.

Causes of Learning Disabilities in Deaf Children

Research has shown that centers of the brain involved in the processing of minute components of the visual scene function independently and are located separately in the cortex. It is conceivable that a viral assault by meningitis or maternal rubella that can wipe out inner ear functioning can also damage minute and scattered areas elsewhere in the cortex. Another known cause of deafness and also of learning disabilities is anoxia (oxygen deprivation), a condition that can result from birth complications. The research by Ratner revealed that the group of deaf students whose etiology of

deafness was anoxia (oxygen deprivation) earned the lowest mean scores on the TVPA. The second poorest performance was by students whose etiology was prematurity (frequently accompanied by anoxia), followed by the performance of those students who were deafened by meningitis and maternal rubella. The best performance was by those students whose deafness was caused by genetic factors and who probably did not suffer cortical damage of any kind.

Public Law 94- 142: The Education of Handicapped Children

According to PL 94-142, the hearing impaired child, the deaf child and the learning disabled child are entitled to services as handicapped children.

> The term "handicapped children" means mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, or other health impaired children, or children with specific learning disabilities, who by reason thereof require special education and related services.

Visual perceptual deficits are included among specific learning disabilities as defined by Section 1401, PL 94-142:

> The term "children with specific learning disabilities" means those children who have a disorder in one or more of the basic psychological processes involved in understanding and in using language, spoken or written, which disorder may manifest itself in imperfect ability to listen, think, speak, read, write, spell, or do mathematical calculations. Such disorders include such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia, and developmental aphasia.

The children included in the research by the author had two

handicapping conditions, i.e., deafness and visual perceptual learning disabilities. The visual perceptual disorder manifested itself in problems understanding and using (sign) language and in problems reading, writing, spelling and/or doing mathematical calculations. However, there is an exclusion clause which can be interpreted in such a way as to restrict funding for services to deaf children with specific learning disabilities:

> Such term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage.

The wording can be misinterpreted to mean that if you are deaf, blind, mentally retarded or physically handicapped you cannot be learning disabled, as well. The research described above and the Annual Survey by Gallaudet University proved that a high percentage of hearing impaired and deaf children have at least one additional primary handicap, specific learning disabilities. Indeed, it is probable that a population of hearing impaired children, whose etiologies of deafness are similar to those of L.D., have a higher incidence of learning disabilities than hearing children. If a deaf child's learning disability is not recognized as a separate, additional handicap, he will not receive the combined professional services that are necessary for his specific needs.

Inappropriate Tests

One indicator of a learning disability is a discrepancy between the child's level of intellectual functioning and academic achievement. Intelligence classifications for hearing-impaired children are based entirely upon performance scales of intelligence tests, such as the Wechsler Intelligence Scale for Children-Revised (WISC-R), Leiter International Performance Scale, or Raven's Progressive Matrices. Verbal scales are not appropriate for deaf children, especially, because of their severe language deficits. The tasks on all of the performance subtests in currently used standardized tests of intelligence require considerable spatial and other visual perceptual skills. If a child has a visual perceptual deficit, he may perform poorly on the performance portion of the I.Q. test and be classified as having less than average intelligence. In addition, the disorder will contribute to poor academic performace. There will be a very small discrepancy, if any, (on paper) between the child's level of intellectual functioning (I.Q. score) and academic achievement. Therefore, his learning problems will not be attributed to specific learning disabilities, but to deafness alone, and worse, to mental retardation. Conclusions are too often drawn from tests that are inappropriate, conclusions that preclude appropriate professional services for each handicapping condition or result in inappropriate class placement or labeling that ultimately destroys the child.

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